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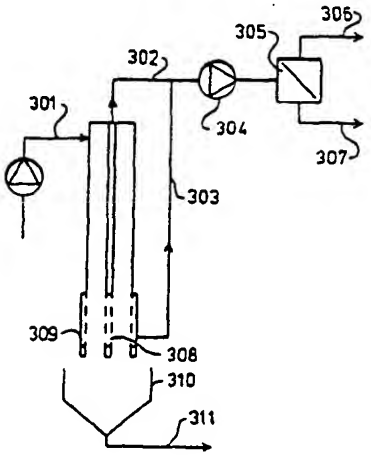
(54) Device, suitable for the continuous recovery of a product in suspension, as well as a process for the continuous recovery of a product in suspension with the aid of the said device.

(57) The invention concerns a device and a process incorporating the device respectively, for the recovery of a product in suspension, which device is characterized by a hollow column which delimits a concentration zone, whereby the internal cross-section of the column, perpendicular to the axis, is constant and the said column is equipped at one end with organs for the inlet of suspension and close to the other end of the column, which is open, it is equipped with one or more filters and organs respectively, for the outlet of suspension liquid passed through the filters and an organ to create an under-pressure on the outlet side of the filters.

fig-3



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top end of the column, while the liquid in the cross-current is forced through a filt r incorporated at the lower end of the column wall. According to the U.S. patent 2.813.781 the column therefore should comprise both at th outlet side for the solid particles a filter for the inlet of the liquid in the cross-current incorporated in the column wall and at least another filter at another location in the column wall for the outlet of the flowing suspension liquid c.q. the liquid flowing in the cross-current. Since in this U.S. patent, mention is only made of filters incorporated in the column wall, the possibilities of scaling up of processes implementing this type of column are limited.

The German patent 1.197.421 describes a vertically placed filter column for the continuous filtration of beer dregs from wort. The filters are located over the entire length of the column. The lower end of the filter column is not open; a screw regulates the outlet of the beer dregs.

The Swiss patent 487.910 describes a device which is not open at the lower end and comprises filter tubes, which filter throughout the entire length. According to the method described in the Swiss patent, the flow rate of the liquid to be filtered, vertically onto the filter surface, must be adjusted so low that the filter cannot be clogged up by the particles present in the liquid.

Finally, in the U.S. patent 1.812.773 a filtration device is described which is operated discontinuously. After the filter is full of filter residue, the filtration is stopped and the filter residue is removed from the filter with the aid of compressed air.

Taking the foregoing into consideration, Applicant has searched for a device of simplified construction, which does not contain any moving components, is open on the product outlet side and is still suitable for the recovery of a product in suspension on a continuous basis.

It was found that the abovementioned goal can be achieved with a device which is characterized by a hollow column which delimits a concentration zone, whereby the internal cross-section of the column, perpendicular to the axis, is constant and one end of the said column, is equipped with organs for the inlet of suspension and close to the other end of the column, which is open, is equipped with one or more filters and organs respectively, for the outlet of suspension liquid passed through the filters as well as an organ to create an under-pressure on the outlet side of the filter(s) present.

The abovementioned expression, "...close to the other end of the column..." refers to the position of the filter or filters, which filters are located on the reverse half of the suspension inlet side, advantageously in the furthest removed quarter of the column and whereby the distance between the underside of the filter or filters to the end of the column, is preferably 1-20% of the column length.

More especially, the suspension liquid is separated from the suspension by the filters and removed from the column by the application of an under-pressure on the outlet side of the filters. Advantageously the under-pressure applied at the filters is regulated in such a way that besides the suspension liquid, air is also led from the open end of the column via the filter residue through the filter. In this way an optimum drying of the filter residue is achieved. The filters implemented in the column can be executed in the shape of one or more filter tubes present in the column (the internal filters) or can be incorporated in the wall of the column (the external filters).

As stated above, the internal filters can with advantage be executed in the shape of tubes with a constant external diameter, which extend from one end of the column in the direction parallel to the axis of the column and whereby in the wall of each tube at least one filter is incorporated, which constitutes a direct connection between the inside of the tube and the inside of the column. In the event that several filter tubes are present, these are equally spaced throughout the cross section of the column.

In addition to the possibility that the filters are internally incorporated, the filters can alternatively be incorporated in the wall at the end of the column. Furthermore, there is the possibility that the filters can be incorporated internally as well as in the wall of the column.

As stated, the filter which for instance, is located in a central filter tube, is incorporated immediately above the entirely open end of the column. The distance between the filter and the lower end of the column is relatively small. By increasing this distance, the time taken for the packed bed to dry can be increased, which will result in a dryer product.

The air forced through the filter residue, displaces a part of the liquid which is still present between the solid particles of the packed bed. So, in the device according to the invention, in addition to the outlet of the suspension liquid, there is also a removal of the suspension liquid still remaining in the filter residue. It has been observed that the degree to which the filter residue is dried, is dependent not only on the under-pressure which is applied at the filters, but also on the speed at which the bed is transported.

As stated, the driving force for the bed transport is determined by the pressure drop applied over the bed, which is caused by the removal of the filtrate via the bed. This driving force is dependent on the bed height, the quantity of filtrate which needs to be removed and the size of the particles in the packed bed. This driving force must overcome the frictional resistance of the packed bed in the column. In certain

Fig. 4 is a schematic representation of a filter chamber of a device according to the invention.

Fig. 5a is a schematic cross-section of a device according to the invention, which is equipped with seven internal filters.

Fig. 5b shows the cross-section Vb-Vb of the device as reproduced in Fig. 5a.

Fig. 6a shows a schematic cross-section of a device according to the invention, which is equipped with nineteen internal filter tubes.

Fig. 6b shows the cross-section VIb-VIb of the device as reproduced in Fig. 6a.

Fig. 7 shows a schematic representation of a device according to the invention, which is equipped with one external outlet for the suspension liquid and an additional inlet for gas.

Fig. 8 shows a device according to the invention, which is equipped with a gas-tight chamber at the open end of the column.

Fig. 9 shows a device according to the invention, in which the suspension zone is divided into two cylindrical concentration zones.

With reference to the Figures 1-9, the following can be further clarified:

The device shown in Fig. 1 has already been covered in the description of the Netherlands Patent Application 86.00793, so that a further explanation here would be superfluous.

Fig. 2 is a reproduction of the washing column according to the European Patent 97.405 in which the following components are schematically represented : 21 the inlet pipe for the suspension, 22 the outlet pipe for the filtrate, 23 the control circuit, 24 the filter, 25 the packed bed, 26 the disintegrator, 27 the re-slurry section, 28 the re-slurry liquid inlet and 29 the product outlet pipe.

Fig. 3 is a reproduction of a device according to the invention in which the following components are schematically represented : 301 the suspension inlet pipe, 302 the filtrate outlet pipe from an internal filter tube, 303 an outlet pipe for the filtrate from an external filter, 304 a vacuum pump, 305 a liquid gas separator, 306 an air outlet pipe, 307 a filtrate outlet pipe, 308 an internal filter, 309 an external filter, 310 a receptacle for the recovered product and 311 an outlet pipe for the recovered solid matter. The diameter of such a column filter according to the invention, can for example, be 60 mm.

Fig. 4 is a reproduction of a filter section of a column filter with for example, a diameter of 60 mm. in which the following components are schematically represented : 41 an internal filter with for example, a height of 40 mm. 42 an external filter with for example, a height of 40 mm. 43 a cone with for example, a height of 20 mm. 44 an outlet pipe for the filtrate and the air from the internal filter, 45 an outlet pipe for the filtrate and the air from the external filter, 46 a cover plate for starting up of the column filter and 47 a locking ring for the aforementioned cover plate.

Fig. 5a is a reproduction of a device according to the invention with an enlarged diameter of for example, 150 mm. in which the following components are schematically represented : 51 the filter device itself, 52 the inlet section, 53 the condensation and transport sections, 54 the filter section with a height of for example, 40 mm. 55 the conical outlet section with a height of for example, 100 mm. 56 the feed pump for the inlet of a suspension, 57 the control pump, 58 the (vacuum) pump and 59 a buffer vat/under-pressure regulator.

Fig. 5b is a reproduction of the distribution of the seven internal filter tubes with for example, a diameter of 20 mm. across the cross-section Vb-Vb of the column.

Figs. 6a and 6b respectively, are reproductions of a 300 mm. column filter with 19 filter tubes in which the following components are schematically represented : 61 the inlet for the suspension, 62 the filtrate and air outlet pipe from the internal filters and 63 the filters themselves. Fig. 6b shows the cross-section VIb-VIb of the column filter with a diameter of 300 mm. with the associated distribution of the 19 filter tubes.

Fig. 7 is a reproduction of a column filter with an external filter for the filtrate and an additional external filter for the inlet of gas. In this figure, the following components are schematically represented : 71 the column filter equipment itself, 72 the filter for the liquid and gas outlets. 73 the filter for the gas inlet, 74 the suspension input pipe, 75 the gas input pipe and 76 the liquid and gas outlet pipe. The pressures P1, P2, P3 and P4 are the pressures at their respective locations. Hereby the pressure P1 on the suspension inlet side is higher than P2 at the outlet filter. Furthermore, the pressure P3 at the air input filter is also higher than P2 at the outlet filter. For instance, these pressures can have the following values: P1 = 200 kPa, P2 = 50 kPa, P3 = 150 kPa and P4 = 100 kPa.

Fig. 8 is a reproduction of a device according to the invention, whereby the outlet side is not in contact with the environmental air, but is closed in order to enable a higher pressure on the outlet side to be regulated. In this Fig. 8 the following components are represented : 81 the column filter equipment itself, 82 the filter for the liquid and gas outlets, 83 a means for increasing the pressure on the outlet side, 84 the suspension input pipe, 85 the gas input pipe, 86 the liquid and gas outlet pipes and 87 the outlet pipe for the solid particles.

Comparative example 2

A tubular centrifugal device was implemented to centrifuge a sample of the abovementioned PVC suspension, for a duration of 60 seconds. The rotational speed of th centrifuge was 5,200 rev/min. (acceleration 4,500 m/s^2). The dry solid content of the product obtained was 78.9 wt.%.

Example 1

The abovementioned PVC suspension was added to the device according to Fig. 3. The height of the filter equipment was 430 mm. and internal diameter was 60 mm.

The lengths of the external and internal filters were 37.5 mm. and 31 mm. respectively and the diameters were 62.5 mm. and 20 mm. respectively. The distance from the lower end of the filters to the end of the column was 20 mm. The inlet pressure was 175 kPa and the pressure on the filtrate outlet side was 40 kPa. The filtration capacity was 5 liters filter residue per hour. The dry solid content of the recovered product was 77.4 wt.%.

It follows from the abovementioned tests, that with the filtering device according to the invention, a filter residue with the same degree of dry solid content can be obtained on a continuous basis as with the conventional loading techniques, such as with the aid of a Büchner filter and a tubular centrifugal device.

Claims

1. Device, suitable for the recovery of a product in suspension, characterized in a hollow column, which delimits a concentration zone, whereby the internal section of the column perpendicular to the axis, is constant, which column is equipped at one end with organs for the inlet of suspension and close to the other end of the column, which is open, is equipped with one or more filters or organs respectively, for the removal of the suspension liquid passed through the filters and with an organ to create an under-pressure on the outlet side of the filters.

2. Device according to claim 1, characterized in that the internally incorporated filters are executed in the shape of tubes of a constant external diameter, which extend from one end to the other end of the column in a direction parallel to the axis of the column and that in the wall of each tube, at least one filter is incorporated, which forms the direct connection between the inside of the tube and the inside of the column.

3. Device according to claim 2, characterized in that the column has a circular cross-section and in the event that several filter tubes are present, these are evenly distributed throughout the cross-section of the column.

4. Device according to claim 1, characterized in that at the other end of the column, one or more filters are incorporated in the wall of the said end.

5. Device according to one or more of the claims 1-4, characterized in that the filters are incorporated internally as well as in the wall of the column.

6. Device according to one or more of the claims 1-5, characterized in that the other end of the column has a conical shape, the diameter of which is smaller than the remainder of the column.

7. Device according to claim 6, characterized in that the diameter of the other end of the column is 1-10% less than the diameter of the remainder of the column.

8. Device according to one or more of the claims 1-3 and 5-7, characterized in that the ends of the filter tube or filter tubes are of conical shape, with the understanding, that the diameter of the conical end is greater than the diameter of the tube.

9. Device according to claim 8, characterized in that the diameter of the conical end of the filter tube or filter tubes is 1-20% greater than the diameter of the filter tube.

10. Device according to one or more of the claims 1-9, characterized in that the organ for the outlet of suspension liquid passed through the filter or filters, is equipped with a pump to create the under-pressure.

11. Device according to one or more of the claims 1-10, characterized in that the column is equipped at the other end with organs for the inlet of a gas stream, which organs, seen in the transport direction of the suspension particles, are located after the filters.

12. Device according to one or more of the claims 1-11, characterized in that the open end of the column is equipped with a gas-tight chamber, which chamber is equipped with organs for the outlet of the recovered suspension particl s and the inlet of a gas stream.

Fig-1

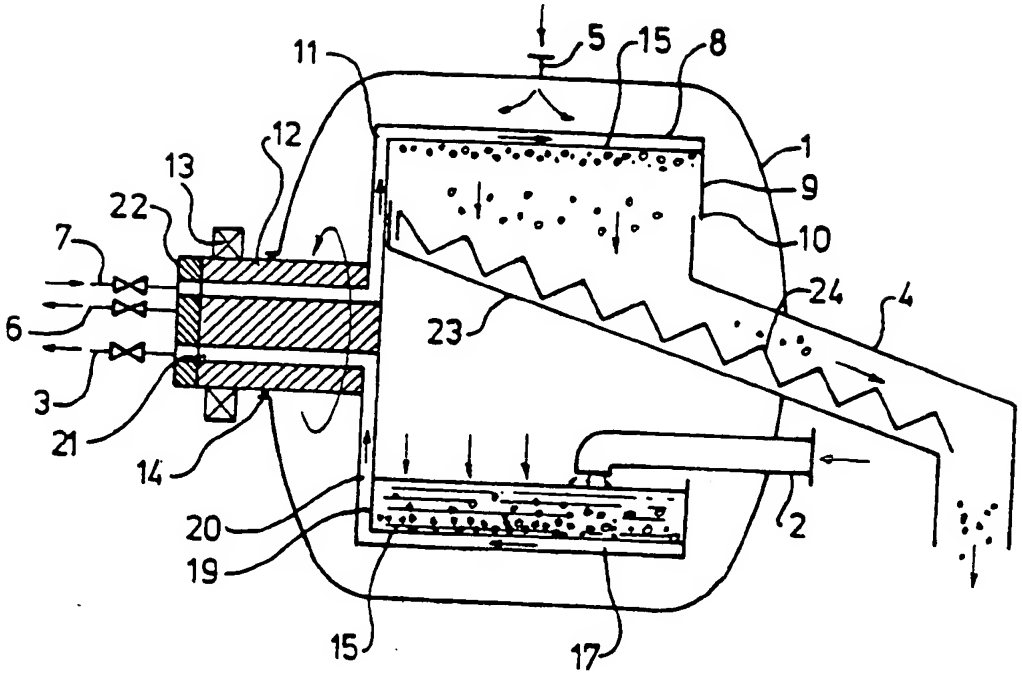
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Fig-2

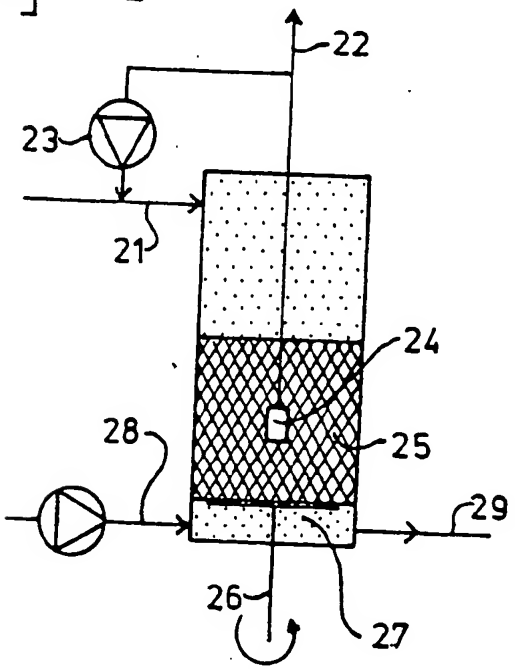
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Fig-5a

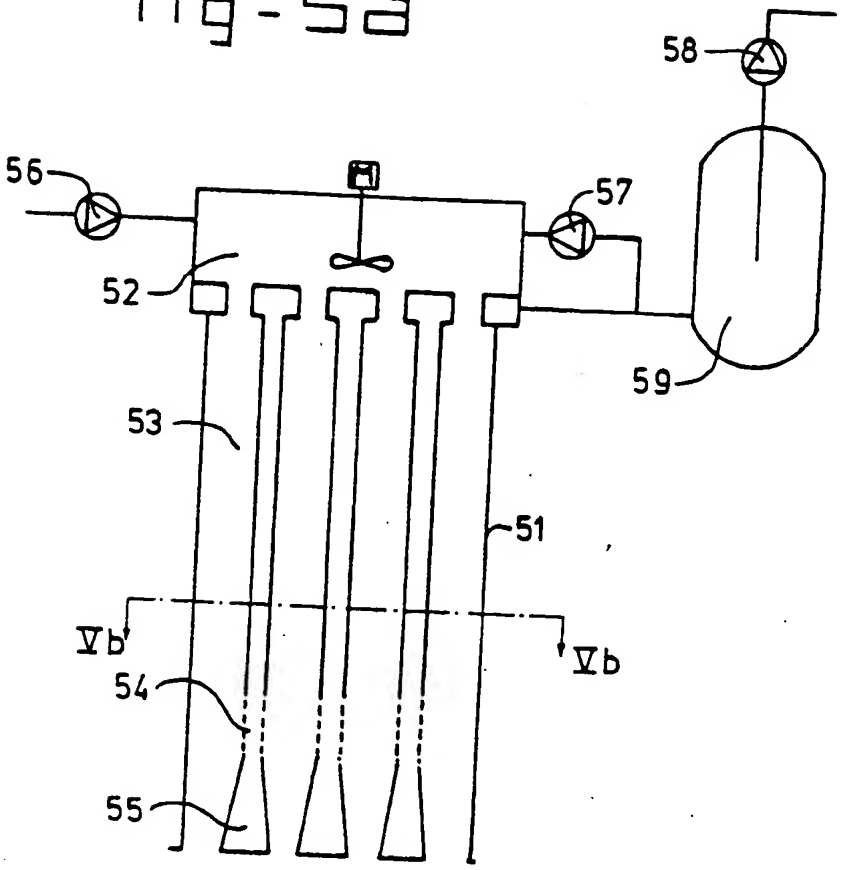


Fig-5b

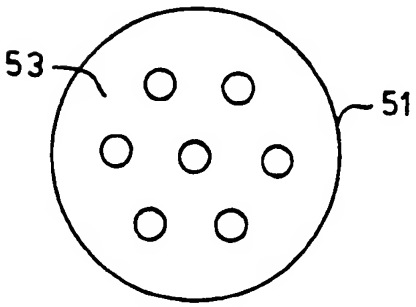


Fig - 6

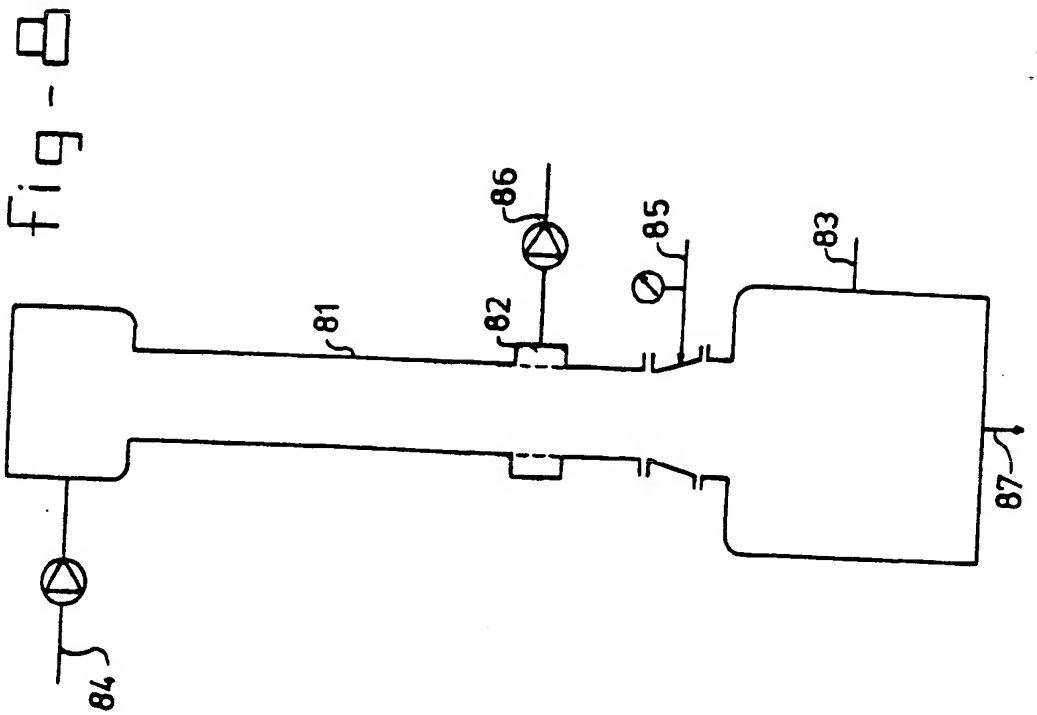
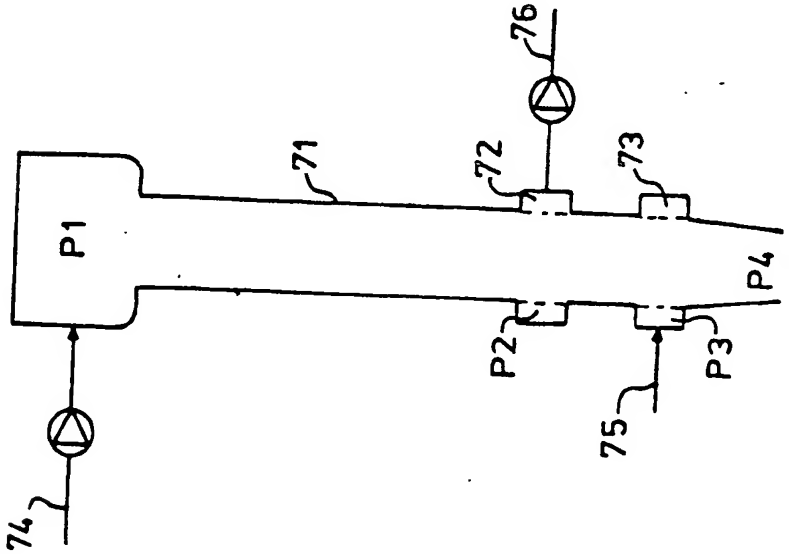


Fig - 7



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 20 1232

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X A	US-A-2 813 781 (T.S. MERTES) * Column 2, lines 44-72; columns 3-6 *	1,2,4,6 ,18 11	B 01 D 29/11 B 01 D 29/54 B 01 D 29/84
X	DE-B-1 197 421 (WIEGELWERK) * Columns 3,4 *	1,2,4,6 ,13,18	
X	CH-A- 497 910 (TOSHIN SCIENCE) * Columns 1-6 *	1-3,6, 10,17, 18	
X A	US-A-1 812 773 (HUGH HARLEY CANNON) * Pages 1-4 *	1,3,6 8,11,12 ,14,16	
A	DE-A-2 921 871 (SELWIG & LANGE) * Figure 1 *	5	
A	US-A-3 319 437 (GOINS) * Figures 1,4 *	1-18	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	FR-A-1 352 915 (FIVES LILLE-CAIL) * Pages 1,2 *	1-18	B 01 D
A	DE-A-3 211 865 (GEWERKSCHAFT AUGUSTE VICTORIA) * Figures 1,2 *	1-18	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30-08-1990	DE PAEPE P.F.J.

CATEGORY OF CITED DOCUMENTS

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